Chapter 10: Linear Regression test on Slope

LSR Line:

Book/Formula Sheet:

Statistic	Parameters

Book/Formula Sheet

- The LSR line is a basis for …

- The LSR line estimates:

a and b

- Unbiased …
- Normally…

e_i = residuals = deviations

-
-
-
-

residuals =

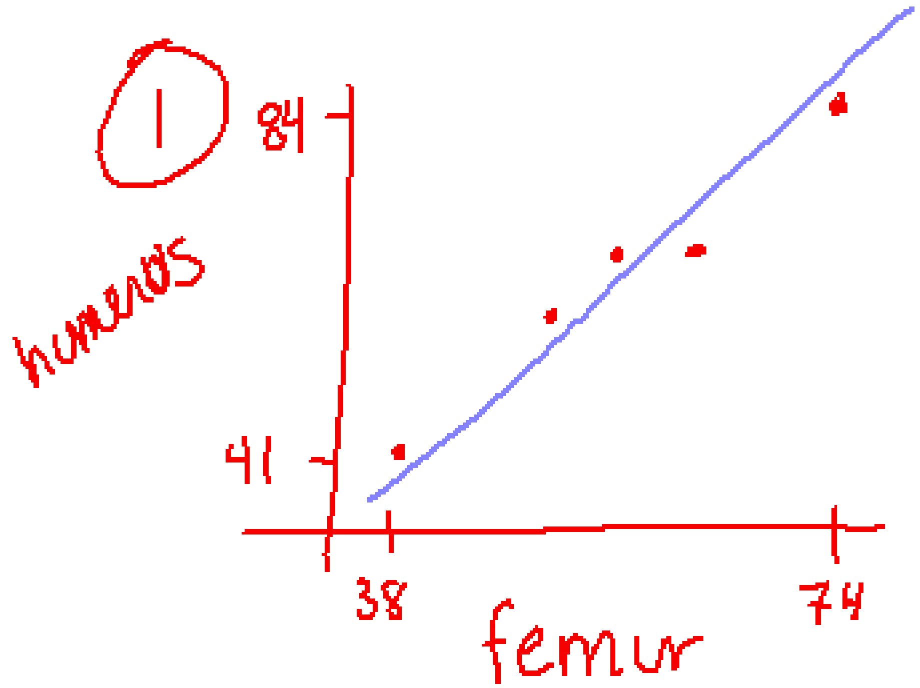
Σe_i =

σ = Standard deviation of residuals

- estimated
- s=
- df =

WORKSHEET 10.1

1



$$\hat{y} = -3.66 + 1.2x$$

$$r = 0.994$$

$$r^2 = 0.988$$

(b) β estimate $= b = 1.2$

α estimate $= a = -3.66$

β = slope = change in cm of humerus per cm of femur

(c) $$s = \sqrt{\frac{\sum e_i^2}{n-2}} = 1.982$$

sum(LRESID²)

Test of Significance on β

- Testing…

Hypotheses

Ho:

Ha:

Test Statistic

$t =$

P-Value

Conclusion

-
-
-

Confidence Interval

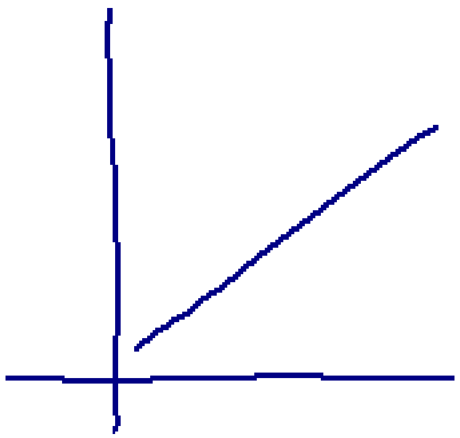
Interpretation:

Assumptions

HW: p. 695-696 #1

a) don't do

b) $\hat{y} = 43.383 + 0.07325x$



Ho: $\beta = 0$
Ha: $\beta > 0$

$t = \dfrac{b}{SEb} = 2.849$

$P(t > 2.849 \mid df = 58) = \text{tcdf}(2.849, E99, 58) = 0.00303$

- We reject Ho b/c p-value < alpha = 0.05.

- We have sufficient evidence that the slope of the population regression line is greater than 0.

- Thus, as Length of Service increases, so do wages.

c) stated in conclusion of test of significance

d) 95% confidence interval:

$$b \pm t^*(SEb) = (0.07325) \pm (2.000)(0.02571)$$

$$= (0.02183, 0.12467)$$

$$\frac{\Delta y}{\Delta x} = \frac{\$}{yr.}$$

We are 95% confident that the slope of the population regression line between length of service and wage is between 0.02183 and 0.12467 years/dollars.

Since 0 is not in the interval, and the entire interval is positive, we have evidence to say that the relationship between the two variables is positive.

Complete #5b from the textbook (page 696)

Ho: $\beta = 0$

Ha: $\beta > 0$

$$t = \frac{b}{SEb} = \frac{1.8396}{0.1408} = 13.0653$$

P(t> 13.0653| df= 38) = tcdf(13.0653, E99, 38) = 6.2273×10^{-16}

- We reject our Ho b/c p-value < alpha = 0.05.

- We have sufficient evidence that the slope of the population regression line is greater than 0.

- Thus as the years increased, yield increased as well. Over time, yield of corn in the U.S. has increased.

95% confidence interval:

$$b \pm t^*(SEb) = (1.8396) \pm (2.021)\,(0.1408)$$

$$= (1.555,\ 2.1242)$$

We are 95% confident that the slope of the population regression line between yield of corn and year is between 1.555 and 2.1242 bushels per acre/year.

Testing when you are given the data (no computer output):

* put data into L1 and L2

* got to STAT --> TESTS --> LinRegTtest

$t = \frac{b}{SE_b}$

* Input: L1, L2, Ha

  **leave regEQ blank

  ** Frequency = 1

* Output:

  t

  p-value

  a

  b

  s (NOT SEb... this is the std. dev. of the residuals)

  r^2

  r

Weight vs. GPA

$y = 2.572 + 0.0027x$

Ho: $\beta = 0$
Ha: $\beta < 0$

$$t = \frac{b}{SEb} = 0.665$$

$P(t < 0.665 \mid df = 7) = 0.7363$

- **We fail to reject Ho b/c p-value > alpha = 0.05.**

- **We have sufficient evidence that the slope of the population regression line is = 0.**

- **Thus as weight increases, GPA is not affected.**

test statistic = 0.665

estimate for B = 0.0027

df = 7

SEb => $0.665 = \dfrac{0.0027}{SEb}$ **SEb = 0.004**

p-value = 0.736

$b \pm t^*(SEb) = (0.0027) \pm (2.365)(0.004)$

$= (-0.00676, 0.01216)$

We are 95% confident that the slope of the population regression line between weight and GPA is between -0.00676 and 0.01216 points/pound.

correlation = r = 0.2437 = weak

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r2 = 0.0594 = 5.94%

5.94% of the change in GPA is due to the change in Weight.

Ho: $\beta = 0$

Ha: $\beta > 0$

$t = \dfrac{b}{SEb} = 4.226$ $\quad\quad$ $P(t>4.226 \mid df = 10) = 8.769 \times 10^{-4}$

- We reject Ho b/c p-value < alpha = 0.05.

- We have sufficient evidence that the slope of the population regression line is greater than 0.

- Thus as quarter increases, points scored increases as well.

90% interval: $b \pm t^*(SEb) = 2.633 \pm (1.812)(0.623)$

$= (1.504, 3.762)$

We are 90% confident that the slope of the population regression line between quarter and points scored is between 1.504 and 3.762 points/quarter.